Growing Broadleaves for Quality Timber

Choice of Planting Stock

This Guidance Note is one of a series summarising information presented at a seminar on "Growing Broadleaves for Quality Timber", held in February 2010 as part of FC Scotland's Timber Development Programme. These notes provide information on all the main aspects of growing quality broadleaved timber, from choice of planting stock through to timber marketing, together with relevant references and links to more detailed information.

This presentation, which was delivered by Jason Hubert (Forest Research), is available for download through the seminar web page.

Why choosing the right planting stock matters

Choice of planting stock is critical in determining the performance of trees, especially growth rates and timber quality. There are two main aspects to the choice:

- Choice of the correct *provenance*
- Choice of *improved material* where this is available.

Provenance choice is very important because the *phenotype* (i.e. performance) of trees is determined by their *genotype* (i.e. genetic make-up) and the *environment* in which they grow (which includes both natural factors and the influence of management regime). This is expressed by geneticists as follows: ***Phenotype = Genotype x Environment*** and can be summarised as: ***"What you get" = "What you start with" x "What you do with it"***.

So, a good phenotype cannot be produced by good silviculture alone, but requires that a good genotype of plant is used to start with.

What aspects are influenced by choice of planting stock?

There are some very clear examples from research in Britain that demonstrate that flushing, form, forking and growth rates are all determined by provenance. Birch displays big differences in flushing and senescence times, which can be clearly visible even in the nursery. Ash provenance trials have demonstrated large differences in both growth and form, with some provenances being both slow growing and poor form and therefore entirely unsuitable (e.g. ones from Eastern Europe). In ash, growth rates also vary between provenances, and this can be linked to timber quality because fast growing trees produce

better quality timber with more latewood. Similarly shake in oak is partly genetically determined as late flushing provenances tend to have larger vessel sizes which leads to a higher chance of shake.

The scale of variation between different provenances can be very substantial. For example the fastest growing provenances in some trials of oak, ash and birch have early growth rates 50% to 100% faster than the slowest ones.

Example of problems

There are a number of "horror stories" in the choice of planting stock for some broadleaved species, which have caused significant problems for practitioners. For example, two similar species of ash, *Fraxinus excelsior* and *Fraxinus angustifolia,* were not recognised as separate species in central Europe, where they naturally hybridise. Seed and plants which were bought as *Fraxinus excelsior* and widely planted in Ireland during the 1990s, turned out to be either *Fraxinus angustifolia* or the hybrid, which display poor form in Ireland. An additional problem is the common practice of collecting seed by felling single large trees, with entire collections being made from just a few trees.

In cherry, southern sources are known to be coarse branched and prone to bacterial cankers, but nonetheless these provenances have been made widely available, often as a bi-product of jam making. In silver birch, Finnish origin material often dies back 10-20 years after planting in Scotland due to spring frost damage.

Implications of poor provenance choice

The main outcomes of poor provenance choice are:

- Poor height growth and therefore higher inputs are required for initial establishment;
- Poor form, potentially leading to final crops with very little value without heavy investment in pruning;
- Poor adaptation, leading to potential loss of the crop due to disease or abiotic damage.

Where to look for the best planting stock

The best options for good quality planting stock are seed origins that are within 2 degrees latitude south of the planting site (i.e. the northwards transfer is no more than 2 degrees) – though for some species such as oak greater transfer distances appear to give acceptable results. Within this zone "registered seed stands" should be preferred because they provide

far better genetic quality than using ordinary "source identified" stands of unknown quality. Improved material from breeding programmes is best, but this is a long term process and at present little such seed is available.

Tree breeding

Tree breeding in broadleaves is a slow and relatively expensive process. However, there are good returns for the forestry and timber industries in the long term. A good example of a tree breeding programme is the one for silver birch organised by the British and Irish Hardwood Improvement Programme. The steps involved in this are:

1. Locating plus trees, i.e. single trees of the best phenotype.
2. Taking cuttings of all these trees and grafting them onto rootstocks.
3. Growing all the clones together in one location. Normally this is in a large poly-house where all these superior tree interbreed.
4. Collecting the seed.
5. Genetic gain trials - testing the seed against ordinary commercial sources to demonstrate its superiority.

Currently there are 3 collections of silver birch that are going through this process, originating in Tayside, the Cairngorm region and Southern Scotland/Northern England. The first genetic gain trials are due to be planted in 2011.

An overview of progress in other species is shown in the tables below, which give details of the number and locations of plus trees (Table 1) and the progress of establishing seed orchards and making seed available (Table2).

For more information on broadleaved tree breeding see www.BIHIP.org and for detailed guidance on provenance choice see the following Forest Research publications:

References

Hubert, J. (2005). Selecting the right provenance of oak for planting in Britain. *Forestry Commission Information Note*, **77**, Forestry Commission, Edinburgh, 8pp.

Hubert. J and Cottrell, J (2007) The role of forest genetic resources in helping British forests respond to climate change. Forestry Commission, Edinburgh, 8pp

Hubert, J. and Cundall, E. (2006). Choosing provenance in broadleaved trees. *Forestry Commission Information Note*, **82**, Forestry Commission, Edinburgh, 12pp.

Table 1: Plus trees selected in the main timber species suitable for Scotland

Country	Seed zone	Number of Plus Trees in BIHIP collections					
		Silver birch	Wild cherry	Ash	Oak	Sycamore	Beech
Scotland	105	-	-	2		-	
Scotland	106	-	1	5	1	-	-
Scotland	107	2	1	9	1	3	1
Scotland	108	-	1	15	1	4	2
Scotland/N England	109	3	-	3	3	-	4
Scotland	201	20	2	14	3	-	10
Scotland	202	64	4	7	1	-	7
Scotland	203	6	3	18	10	13	16
Scotland/N England	204	8	-	7	5	1	8
	Totals RoPs 10 and 20	***103***	***12***	***80***	***25***	***21***	***48***
N England	301	15	3	6	2	7	3
N England	302	7	8	28	1	30	1
Wales + SW England	Rest of Region 30	-	22	41	9	1	7
England	Region 40	6	106	214	122	11	~40
	Total GB	**131**	**151**	**369**	**159**	**70(GB) 90 (UK)**	**99**

Table 2: Overview of status of tree improvement programmes and seed availability

Tree species	No. of FC registered seed stands in Scotland /(England)	No. of plus trees identified / (grafted)		No. of seed orchards / No. of selections in each orchard		Genetic (progeny) trials of improved material in Scotland	Seed/stock commercially available
		Scotland	Northern England[1]	In Scotland	In England		
Ash	1 (3)	73 (21)	7 (0)	0	2 clonal (40-48 clones) 4 BSOs[2] (21-36)	0	BSO's are currently "qualified" – but no seed has been collected yet. Rogued early 2009; hopefully seed available in 2009/10. One poor registered seed stand in Scotland is not collected from.
Beech	5 (20)	46 (0)	6 (0)	0	0	1[3]	From registered seed stands only
Oak	6 (55)	10 (10)	5 (5)	1 BSO (31 parents)	7 (66 parents)	0	From registered seed stands only
Silver birch	4 (0)	154 (135)	31 (31)	2 clonal (43-47 clones)	0	0	Small quantity of seed in 2007 from the "Tayside" seed orchard. Collections are occasionally made from registered seed stands.
Sycamore	0 (7[4])	21	38	0	0	0	Now available from new seed stands in N England.
Wild cherry	0 (0)	12 (12)	14 (12)	0	5 clonal (plus trees) (17-154 clones) 2 clonal (seedling selection) (162 -285 clones)	1	10,000 "Wildstar" plants produced annually by micropropagation from 11 superior clones. Seed available from 3 orchards in S England.